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ABSTRACT

A great deal of experimentation with telecommunications technologies is occurring in both New Zealand and Atlantic Canadian rural schools. New Zealand has developed a National Information and Communications Technology Strategy, the objectives and initiatives of which are described. On both the North and South Islands, small rural schools have developed electronic networks that link the schools to each other and to larger urban high schools, polytechnic schools, and the New Zealand Correspondence School in Wellington. In Newfoundland (Canada), the Memorial University of Newfoundland has assisted in creating advanced placement web-based mathematics and science courses that are delivered via satellite to an intranet of rural schools. Virtual classes suggest several implications: the more public nature of teaching online may require changes in teaching methods; the integration of virtual and traditional classes may lead to new professional hierarchies as some online teachers are hired by networks of schools and are assisted by on-site teachers; the linking of schools to share virtual classes will require academic and administrative collaboration in scheduling, curriculum development, and the sharing of teachers and resources; technical support and instructional design expertise in the preparation and upgrading of online courses will become a priority; the unsupervised nature of virtual classes requires students to learn independently and ask questions; and pedagogical difficulties involved with teaching across multiple sites demand particularly careful preparation on the teacher's part. (TD)

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By Ken Stevens

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The Development of Virtual Classes in New Zealand and Canada - Some Implications for Administration and Policy

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Abstract

The academic and administrative interfacing of schools in dispersed locations has led to the emergence of new educational structures - digital intranets and, within these, virtual classes. The electronic construction and deconstruction of virtual classes between sites during the course of a school day challenges traditional notions of the school and ways in which education is administered.

This paper reports on recent research in New Zealand and Canadian virtual classes and considers the implications of their growth for the administration of education at local (including classroom) and national levels and for future educational policy.

Biographical Note

Ken Stevens is a Professor of Education at Memorial University of Newfoundland where he holds the Chair of TeleLearning and Rural Education, a research appointment endowed by Industry Canada. His previous appointments were at Victoria University of Wellington and James Cook University of North Queensland. His research interests are in the education of rural people and the application of telecommunications technologies to education. He was recently appointed to two positions he will hold concurrently with his Canadian Chair: as Visiting Professor of Research and Telelearning at Northern College of Education, Aberdeen, Scotland, and as Honorary Research Fellow at Taranaki Polytechnic (Te Kura Matatini o Taranaki), New Plymouth, New Zealand. He lives in Canada and New Zealand and spends some time each year in Scotland.

The Development of Virtual Classes in New Zealand and Canada - Some Implications for Administration and Policy

Telelearning is a new term in the vocabulary of teachers, students and school administrators. The term refers, in its broadest sense, to the application of telecommunications technologies to the delivery of education, particularly by computers, the Internet, satellite dishes and an increasing range of software. Specifically, telelearning refers to on-line learning and teaching and the administration of virtual educational environments. In New Zealand and Canadian schools, teachers with access to appropriate computer technologies and the Internet have the potential of providing instruction at a distance as well as in conventional, face to face, typically urban, classrooms. At the present time there is a great deal of experimentation with telecommunications technologies in classrooms in both New Zealand and Atlantic Canadian rural schools as teachers and students together explore new ways of both teaching and learning. There are administrative and policy implications to be considered in the emerging virtual educational environment in each country.

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Three Stages in the Development of Virtual Classes in New Zealand

Telecommunications technologies have provided ways of sustaining rural educational infrastructures in several regions of New Zealand by enabling teachers and students to electronically link with one another to share resources. The development of telelearning in New Zealand is taking place at a time when many rural schools are under threat of closure because of their small enrollments and, in accounting terms, their relatively high overheads. A feature of telecommunications technologies in rural New Zealand schools is the realization by teachers and administrators of their potential to connect one site with another, thereby challenging educational considerations of institutional size, location and access to human, curriculum and technological resources.

Today many schools in New Zealand have more than one telephone line to enable them to take advantage of developments in teleteaching and telelearning. By linking computers to telephone lines through modems, audiographic technology has developed in several parts of the country. Audiographic teaching, as the name suggests, enables teachers and learners to hear one another and to share print and graphic material on computer screens. This elementary form of telelearning has served many small communities very effectively. In the Canterbury region of the South Island and the north east coast of the North Island of New Zealand, where there is a predominantly Maori community, small rural schools have formed virtual classes to collaboratively teach senior students in a range of specialized High School subjects. When two or more schools interface electronically to combine teaching and learning, a virtual class is formed. Both teachers and students in a growing number of rural schools in New Zealand now have telepresences in multiple sites during the course of a school day. Three stages can be identified in the development of virtual classes in New Zealand.

(i) Telelearning and the Development of Virtual Classes for Rural Maori Communities

In some areas of the north-east coast of the North Island of New Zealand, the population is almost exclusively Maori and many people speak that language fluently. Senior students in three small rural High Schools north of the city of Gisborne have had considerable success in national examinations in the Maori language. However, success in other subjects for many of these students has been difficult to achieve. It has been particularly difficult to attract teachers to vacant positions in schools in this part of New Zealand and it is not uncommon for advertised vacancies to attract no applicants at all. In this situation it has been impossible to provide students with an on-site teacher for most subjects within each school. Many students in this part of New Zealand have, accordingly, been enrolled with the New Zealand Correspondence School in Wellington for many of their High School courses.

To counter the disadvantage of having few on-site teachers in High Schools in this part of rural New Zealand, a small, three-site electronic network was developed to share teaching resources. As well as linking with one another, each site has access to a growing range of extranets (external systems): to larger urban High Schools, to Polytechnics in other parts of the country and to the New Zealand Correspondence School in Wellington. Senior students in the three small, predominantly Maori communities north of Gisborne were provided with access to each of the other two schools in the East Coast network as well as to a small range of non-local educational and vocational resources. This N.E. coast network attracted the attention of educators in the South Island who collaborated in the development of virtual classes for rural communities in the southern part of the country.

(ii) Telelearning and the Development of Virtual Classes for Rural South Island Communities

The Canterbury region of the central South Island of New Zealand contains twelve rural communities, each with its own school. With rural-urban migration many communities in Canterbury have become smaller and enrollments in most schools have fallen. In the last decade some schools faced closure and parents were faced with the prospect of considerable disruption in the education of their sons and daughters.

The development of an inter-school network that became known as "Cantatech" (The Canterbury Area Schools Technology Project) brought twelve rural schools together to consider ways in which teaching

and learning resources could be shared. Each school was able to provide its students with teaching in the core subjects on-site: English, Mathematics and Science, as well as instruction in one or two specialized subjects (eg, French, Japanese, Economics, Agriculture). By collaborating in the teaching of specialist subjects between the schools in this part of rural New Zealand, senior students who wished to receive instruction in courses not locally available have been able to access them from a participating site in the Cantatech network. By mutual consent, designated schools in the Cantatech network accepted responsibility for a particular area of the curriculum in which they had a qualified teacher. In return, schools that provided specialized expertise on-line in a designated area of the curriculum could expect to receive other subjects for the benefit of their own students. As with the NE coast network, the Cantatech network developed selected extranets to polytechnics and other educational organizations to extend educational opportunities for rural Canterbury students.

By collaborating in the appointment of specialist teachers on each Cantatech site to avoid duplication of human resources and encourage the development of a wider range of specialist appointments, each school in the network has been able to provide its senior students with access to an extended range of learning opportunities. Teachers appointed to any of the Cantatech schools were expected to be able to provide courses in both traditional face-to-face mode, on site, as well as on-line, as required. The development of the Cantatech network has brought about many changes in the administrative and academic life of each school. Each school in the network has had to academically and administratively interface with each of the other schools in the region and thereby work collaboratively in the interests of a much broader community than its originally-designated local one.

Because of the necessity of finding new solutions to the delivery of education to geographically isolated senior students, each school in the Cantatech network has had to consider the role of information technology in the curriculum. For teachers, students, administrators and people in each of the participating communities, information technology has become a means to enlarge local educational, and indirectly, vocational, opportunities.

Teleteaching and telelearning in rural Canterbury has challenged the competitive model of schooling in New Zealand and demonstrated the value of a collaborative, integrated virtual organization for senior students. The Cantatech network has empowered twelve small and geographically isolated schools to deliver an extended range of subjects to senior students.

(iii) Current Initiatives - Interactive Education

Since 1998 a National Information and Communications Technology Strategy has been developed and implemented throughout New Zealand (Ministry of Education, 1998). There are four objectives in the strategy and four initiatives have been initiated.

The first objective of the strategy is to improve learning outcomes through the use of ICT in schools in teaching and learning. The second is to increase the effectiveness and efficiency of teachers and schools by helping them to use ICT. The third objective is to improve the quality of teaching and leadership in schools by helping teachers and principals to identify their ICT needs and to develop the skills necessary to meet them. The final objective is to increase opportunities for schools, businesses and government to work together in developing an information technology-literate workforce.

The National Strategy has developed four initiatives:

(a) An On-line Resource Centre

The On-line Resource Centre to provide teachers and schools with a mechanism for the delivery of multi-media resources, including curriculum and administration resources, using the Internet. This central on-line centre is intended to support curriculum materials, provide links to curriculum experts, databases, multimedia and a variety of other sites. Schools are encouraged to create their own websites and to have these placed in the on-line resource centre.

(b) Computer Recycling Scheme

The aim of the computer recycling scheme is to enable more schools to obtain more computers for student and teacher use, at low cost. The scheme has been described as the "recycling and up-grading (of computers) in schools" (Ministry of Education, 1998, p12).

(c) Professional Development for Implementation and Planning

During the first year of the National Information and Communications Technology Strategy, Principals and senior administrators in schools throughout New Zealand were provided with initial professional development opportunities in their local areas as well as information about information and communication technologies for teaching and learning.

(d) Professional Development Schools

Twenty-three schools, strategically selected from throughout New Zealand, were designated ICT professional development lead schools from late 1998. The purpose of the lead schools was to assist the development of ICT in other schools within their local areas. Each lead school was chosen primarily for the ICT expertise on its staff.

The three stages in the development of virtual classes in New Zealand are characterized by:

- their rural origins;
- an emphasis on collaborative teaching and learning within an otherwise competitive school system;
- co-existence of traditional print-based distance education institutions with telelearning (based on information and communication technologies);
- the late stage (1998) of direct government involvement in telelearning;
- a lack of attention to the administrative implications of the development of new, virtual, educational structures within the existing school system.

The Development of Virtual Classes in Canada

The Canadian province of Newfoundland and Labrador is characterized by its predominantly rural social structure, it's distinctive history and it's unique culture. In the 1997-98 school year, there were 391 schools operating in the province of which 260, or 66%, were located in rural communities. Thirty one percent of schools in the province are designated "small rural schools" (N=122) and 75 of these had fewer than 100 students. Seventy of these small rural schools are all-grade (K -12), which means that they must offer a senior high school program. The recent re-organization of Primary, Elementary and Secondary education in Newfoundland and Labrador into ten school districts provided an opportunity to develop the first digital Intranet in the province. (See note 1). As with telelearning in New Zealand, three stages in the development of virtual classes can be identified in this part of Canada.

(i) The Development of Web-based Science Courses

The development of Advanced Placement (AP) Web-based courses in Biology, Chemistry, Mathematics and Physics took place within a development team in each subject area. (See note 2). A lead science teacher in each discipline was paired with a recent graduate in each of the disciplines of Biology, Chemistry, Mathematics and Physics who possessed advanced computer skills including web page design, Java and HTML. The lead teacher and the graduate assistant were advised from time to time by Faculty of Education specialists at Memorial University of Newfoundland in each curriculum area and, where possible, scientists from the Faculty of Science. The extent to which each web-based course was developed by a team of four people varied. Most course development took place through interaction between lead teachers and the recent graduates. Although at times professors had different opinions as to the most appropriate approach to the design of the courses, this model enabled the four courses to be developed over a sixteen-week summer recess period in time for the 1998-1999 school year.

Minimum specifications were adopted for computer hardware and network connectivity. All schools

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involved in the project had DirecPC satellite dishes installed to provide a high speed down-link. In most rural communities in this part of Canada, digital telecommunications infrastructures do not enable schools to have a high speed up-link to the internet. Appropriate software had to be identified and evaluated for both the development of the resources and the delivery of instruction within the Intranet. Front Page 98 was selected as the software package. Additional software was used for the development of images, animated gifs and other dimensions of course development. These included Snagit32, Gif Construction Set, Real Video, and similar packages.

Many software packages were evaluated and finally WebCT was selected. This package enabled the instructor to track student progress, it contained online testing and evaluation, private E-mail, a calendar feature, public bulletin board for use by both instructor and student, a link to lessons and chat rooms for communication between teacher and student. For real - time instruction, Meeting Point and Microsoft NetMeeting were selected. This combination of software enabled a teacher to present real-time interactive instruction to multiple sites. An orientation session was provided for students in June 1998, prior to the implementation of this project in September. Students had to learn how to communicate with each other and with their instructor using these new technologies before classes could begin.

(ii) Teaching Senior Science in Open Classes

In eight schools within the rural Vista school district of Newfoundland and Labrador, 55 students were enrolled in AP Biology, Chemistry, Mathematics and Physics courses. While AP courses are a well-established feature of senior secondary education in the United States and Canada, it is unusual for students to be able to enroll for instruction at this level in small schools in remote communities. It is rare to find high school students in small and remote communities anywhere in the world who are provided with instruction in university-level studies. In Iceland (Stefansdottir, 1993), New Zealand (Stevens, 1995a, 1995b) and Finland (Tella, 1995) there have been attempts to provide alternative models for the delivery of education to rural students. The Vista school district initiative challenged the notion that senior students in small schools have to leave home to complete their education at larger schools in urban areas. By participating in open classes in real (synchronous) time, combined with a measure of independent (asynchronous) learning, senior students were able to interact with one another through audio, video and electronic whiteboards. From time to time they met for social occasions and to spend some time with their science teachers in person.

The electronic linking of eight sites within the Vista School district to collaborate in the teaching of AP Biology, Chemistry, Mathematics and Physics created a series of open classes in rural Newfoundland. The creation of the Vista School District Digital Intranet was an attempt to use information and communication technologies to provide geographically-isolated students with extended educational and, indirectly, vocational opportunities. This has been part of a broader pan-Canadian initiative to prepare people in Canada for the Information Age (Information Highway Advisory Council, 1995,1997). The development of the Digital Intranet within a single school district involved the introduction of an open teaching and learning structure to a closed one. Accordingly, adjustments had to be made in each participating site so that administratively and academically, AP classes could be taught.

Research into the organization of senior students who were independent learners in a networked environment in New Zealand (Stevens, 1994) preceded the formation of the Vista Digital Intranet in Canada. Independent learners in New Zealand were found to learn effectively and were able to obtain very satisfactory results in national examinations within an electronic network of small rural schools. In the New Zealand situation though, students usually had at least one teacher on site to assist with questions of an academic nature. In the Canadian Intranet, this was not always possible. A question facing teachers and researchers in the initial stage of the Vista Digital Intranet was whether students who were not used to being unsupervised could cope with new freedom and accept increased responsibility for their learning. Students were unanimous at the conclusion of the Canadian school year, that to be successful in an AP on-line course, it was necessary to be able to learn independently, cope with a high volume of work and be willing to ask teachers and other learners questions as they arose (Stevens, 1999).

It was recognized early in the 1998-1999 school year that a common schedule had to be adopted

throughout the school district to allow students to interact with their instructors in the new Intranet. Unfortunately, this was not fully realized until after classes commenced, with the result some instructors had to repeat classes for small numbers of students. It is anticipated that in future there will be both asynchronous as well as synchronous teaching and learning within the Intranet. The initial plan was to allow for five on-line sessions and five off-line sessions. This schedule was not followed in all schools. On-line sessions were scheduled in the morning when network traffic was at its lowest point. Off -line sessions were scheduled in the afternoon.

(iii) The Shift From Closed to Open Teaching and Learning

The province of Newfoundland and Labrador has a high rate of use of satellite dishes per capita and there are many schools in this province with Local Area Networks (LANs). As a province, Newfoundland and Labrador provided excellent opportunities for the development of these technologies.

Students in the Vista Digital Intranet were frequently subject to scrutiny by their peers as they responded through chat-rooms, audio, video and with their AP on-line teacher. The Digital Intranet provided students with access to multiple sites simultaneously, as well as the opportunity to work independently of a teacher for part of the day. The need to prepare for classes before going on-line became increasingly apparent to both teachers and students if the open, synchronous, science classes were to succeed. The advent of the Digital Intranet had implications for students who had to interact with teachers and their peers in a variety of new ways. The teaching of each of the four AP Science disciplines in the Vista Digital Intranet took place within classes that were open between participating sites. Many students experienced difficulty expressing themselves and, in particular, asking questions in open electronic classes when they did not know their peers from other small communities. The organization of social occasions for students learning science in open classes in the Intranet helped overcome these problems. As students became more comfortable with one another, inhibitions such as asking questions on-line were overcome. In future, interaction in the Vista Digital Intranet will be both synchronous and asynchronous.

The major change for the students in the first Digital Intranet in Newfoundland and Labrador however, has been the opportunity that has been provided to study advanced science subjects, as members of open classes, from their small, remote communities. A Digital Intranet has many implications for the management of education, based on the need to ensure all sites collaborate both academically and administratively. The most important administrative issue in the first year of the Vista Digital Intranet has been the co-ordination of timetables across participating sites.

The need for increased technical support for this new, open structure has become increasingly urgent for teachers and students who are using information and communication technologies to teach and learn across dispersed sites. Both have to be provided with expert advice and instruction in the use of new applications. A particular problem has been difficulty in securing and maintaining instructional design expertise in the preparation and upgrading of courses delivered through the Intranet.

Some Implications for Educational Administration and Policy

As telecommunications and computer technologies develop and converge and are supported by an increasing range of software, teachers and students in many places are seeking to incorporate them into classrooms, the delivery of the curriculum and the management of schools. The application of telecommunications to education is an area of education in which small rural schools have acquired positions of leadership in both New Zealand and Canada.

A feature of the advent of telecommunications technologies in rural New Zealand schools is the encouragement of new ways of teaching students. Teachers in New Zealand telelearning networks have discovered that teaching across multiple sites is very different from teaching in a conventional, face-to-face classroom (Stevens and Moffatt, 1996). With audiographic technology there is a pedagogical difficulty of the teacher not being able to see students who are on-line and so certain cues such as body language are not able to inform interactions. The ability to teach students across multiple sites simultaneously demands particularly careful preparation for managing virtual classes.

For the teaching profession in both countries there are three immediate educational implications in the development of virtual classes:

First, teaching within a Digital Intranet is much more public than teaching face to face in traditional classrooms. One's colleagues can, and frequently do, observe one's on-line classes and can observe one's teaching methods. This leads to new considerations of how one communicates as a teacher in a virtual class (Tiffin and Rajasingham, 1995).

Second, teaching in a Digital Intranet involves the application of a range of information and communication technologies to pedagogy, a process that at present has few guidelines. Those who are currently teaching AP subjects in the Vista Digital Intranet in Newfoundland are very conscious of being pioneers, as were the teachers of the NE Coast and Cantatech networks in New Zealand.

Third, the implementation of teleteaching within the open classroom environment of a Digital Intranet requires the integration of traditional (face to face) and virtual classes. With the appointment of lead teachers for selected areas of the curriculum in the Canadian Intranet, assisted by on-site colleagues at participating sites, new professional hierarchies may emerge.

Traditionally schools have been established to serve geographically-defined communities and in rural areas, the school-community relationship is often a particularly close one. Schools in any community to a considerable extent duplicate what schools are doing in other communities, with students being taught by teachers assigned to them to teach whole classes face to face, or in small groups and, in some cases, individually. This traditional approach to teaching and learning can be considered to be a closed model of schooling.

The open model challenges the closed model of schooling. The open model is based on schools academically and administratively integrating with one another for at least part of a school day. Information and communication technologies facilitate the linking of classes in schools to share teaching, learning and resources. In Newfoundland and Labrador and in New Zealand the open model challenges the closed model of schooling by questioning the need for appointing all teachers to schools, rather than, in appropriate cases, some teachers being appointed to networks of schools. It questions the appropriateness of learners engaging solely with their peers within their own, physical classrooms and, it questions the very notion of a school itself. The open model of the school is grounded in the application of information and communication technologies to teaching and learning and the construction and deconstruction of virtual, open classes.

The broader educational and sociological implications of the move from closed to open classes have yet to be considered. Collis (1996) notes that telelearning is the future of distance education. The development of new, virtual educational structures in both Canada and New Zealand within which telelearning can develop will provide frameworks within which this claim can be tested in the new millennium (Stevens and Moffatt, 2000).

Notes

1. The Vista School District (District 8) contains 18 schools ranging in student enrolment from 40 to 650. The region in which the Vista School District is located extends from Bonavista in the north, (the place where John Cabot landed in North America in 1497) to the Burin Peninsula in the South. It is a large geographic area covering about 7000 square kilometres. The region has a population of about 35,000 people and an economy supported by a diverse infrastructure including fishing, forestry, farming, mining, aquaculture and tourism. The Vista School District was formed in 1996 and became a legal entity in January 1997. There were 5165 students enrolled in the 18 schools in the district who were taught by 366 teachers. The Vista School District is approximately two hours by road from the capital city, St Johns, which is the location of Memorial University of Newfoundland. Eight schools within the Vista School district, together with the TeleLearning and Rural Education Centre of Memorial University of Newfoundland, formed a digital Intranet within which senior science courses were taught in open classes.

2. Advanced Placement (AP) courses enable senior students to begin undergraduate degrees with part of their program completed from high school if their AP courses are passed at grade levels specified by the university of their choice.

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